A 2 Level Method to Enhance TCP Flows Throughput

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Abstract

Over the past few years, Wireless Local Area Networks (WLANs) have gained an increased attention and a large number of WLANs have been deployed in universities, companies, airports etc.TCP(Transport protocol) protocol makes great plan as a reliable protocol in transport layer. A new protocol has been taken into consideration aspect of it in WLAN .A new method is devised to enhance throughput of TCP flows according to change of the mac sub layer .Then a 2 level priority method is presented to increase throughput of these flows and finally, our proposed method is compare with another model. Results demonstrate how our model enhances this parameter compared to another patterns.

Keywords

TCP; Throughput; 2 Level Priority; Wireless Lan

Introduction

Nowadays, wireless networks application is under the territory of wifa and this standard decreases the limitation of transmission media of bandwidth, efficiency management and offers the best quality of service to users. Transmission Control Protocol(TCP) used as a popular protocol of transport layer is a connection oriented protocol that transmits reliably data packet(segment), to end users. Improvement of efficiency and throughput of TCP protocol in wireless network is as important as the improvement of usage of these kind of networks. On the other hand, a lot of applications use TCP as a protocol of transport layer and whereas many users of internet employ web based service, hence most significant capacity of internet traffic is base on the TCP packet. The observation on internet traffic has demonstrated that TCP packets make more that 90% network traffic. The fundamental problem of this protocol is the unfairness, which means that allocating media is almost equal and fairness for all of the users. Since the creation of proper condition for transmission TCP packet in wireless networks plays a significant role in enhancement of these network capability, hence unfairness is investigated and studied.

Problem Overview

Unfairness is researched as many standpoints but our interest is "investigating and overcoming unfairness between throughput of upstream against downstream TCP flows. The majority of the IEEE 802.11 based WLANs employ Distributed Coordination Function (DCF) in Wireless Access Points (AP) to arbitrate the wireless channel among mobile nodes. Because of DCF algorithm of MAC sub layer , all of mobile nodes have access to network(chanel) equally, which means that the access point and mobile nodes have equal access to bandwidth. If all of the nodes are in sending mode(upstream flow) or receiving mode (downstream flow), they can divide the bandwidth equally and fairness is established between nodes. However, imagine the case that one mobile node is in Sending mode and N mobile nodes are in Receiving mode(. In this case half of bandwidth is accessed by one sender and the othe half is divided between the N nodes which are in receiving mode (downstream flow).1/N of half of the bandwidth is allocated to each node in receiving mode. Therefore, however the number of receiver(node) is increased, then a sender can access bandwidth manifond of one receiver and this ratio is increased linearly (base on increasing N), and this unequal access of every node to bandwidth poses "UNFAIRNESS" between upstream and down stream flows.As,it can be seen that DCF protocol devised for equal accessing of bandwidth, poses unfairness. The main goal of this project is to develop a novel method to overcome Unfairness in TCP flows and allocate bandwidth between Upstream and Downstream TCP flows in Fairness mode. Afterthat, the throughput of total TCP flows is increased versus other purposed models(like DCF, DCF+, BDCF.ets).

Related Work

Most of the current WLAN implementations are based on the IEEE 802.11 standard, which supports two basic mechanisms for channel arbitration: Distributed Co-

ordination Function (DCF) and Point Coordination Function (PCF). The implementation of DCF in IEEE802.11 compliant devices is mandatory while provision of PCF is optional. DCF is based on the traditional CSMA/CA paradigm and provides equal channel access to all participating Wireless Stations (STAs). In contrast, PCF, a centralized scheduling algorithm, requires a point coordinator (PC) at the AP to control the channel access. The default scheduling algorithm of IEEE 802.11 PCF is a round robin scheme and may not always be ideal. Due to the inherent complexity involved with the deployment of PCF, most of the current implementations of IEEE 802.11, even in hot spot scenarios, use DCF access mechanism. However, DCF poses serious unfairness problem between upstream and downstream flows. With DCF, the channel share of the A would be a fraction of total number of transmitting STAs in its service area. All STAs, including AP, have the equal channel access. As a result, the share of the channel obtained by the AP is nearly equal to the share of any other STAs under its coverage. This results in unfair sharing of the bandwidth among upstream and downstream flows. All the downstream flows (flows that are destined for wireless stations) have to utilize the AP's channel share while the upstream flows originating from different STAs enjoy a larger share. With the increase in the number of STAs under the AP's coverage, the downstream flows would suffer from relatively low share of the available bandwidth. To better illustrate the unfairness problem, a typical WLAN hotspot scenario is taken into consideration. A set of wireless users (STAs) is connected to the internet through an AP. All the traffic to and from the STAs passes through the AP and thus the wireless link becomes the bottleneck for all the traffic. It is assumed that STA1-STA5 receive UDP traffic from server S (downstream flows); whereas STA6-STA10 transmit UDP traffic to server S (upstream flows). In this scenario, the AP, and STA6-STA10 will contend for the wireless channel through the regular IEEE 802.11 DCF. It is recalled from previous paragraph that DCF gave nearly equal channel share to all the contending nodes in a neighborhood. Thus, the channel share obtained by the AP (and hence the combined downstream traffic) would nearly be equal to the individual shares of other contending STAs (STA6- STA10). In other words, the bandwidth available to the individual flows ending at STA1- STA5 would be a fraction of the bandwidth available to the individual upstream flows of STA 6-STA 10. Interestingly, this scenario is just the reverse of a typical wired access network (e. g. DSL.), where bandwidth available to downward flows is always higher that to upward flows.

In order to overcome the aforementioned problem, researchers have proposed a simple MAC layer enhancement to IEEE 802.11 DCF, called Bidirectional-DCF (BDCF), and specifically addressed the upstream/downstream unfairness by providing the access point, when high load is experienced. In particular, if an access point's MAC receives a DATA packet, instead of transmitting a regular MAC layer ACK, it checks the buffer for an outstanding packet to any of the STAs. If a packet is found, then it will send the DATA with a piggybacked ACK after SIFS (Small Inter-Frame Space) time, thus eliminating the need for a fresh channel contention to transmit this packet. In this way, the access point gets a preferential treatment resulting in a relatively higher bandwidth share as compared to its STAs. BDCF is the enhanced shape of DCF method. As mentioned, DCF protocol in MAC sub layer causes unfairness problem between upstream and downstream flows. Unlike, equal priority between all nodes (mobile nodes and access point) in DCF mechanism that cause unfairness , BDCF provides varying channel access priorities. When access point has upper priority compared to mobile nodes , unfairness problem is overcome (BDCF mechanism). Indeed, the access point sends the packet without any contending with other mobile nodes to access the channel. Therefore, the access point has more contention free transmission opportunities than other mobile nodes to access the common channel .

One Upstream Flow Scenario Style

Some performance parameters used them in the rest of the paper should be identified.

N: number of downstream flows

Ru : average TCP uplink throughput

Rd : average TCP downlink throughput

n : throughput ratio between Ru and nRd

B: Base station buffer size

W: TCP receiver window size

In order to analyse n ratio and identify relevant parameters, different scenariohave been simulated by glomosim simulator, and then describe relation between TCP and MAC sub layer which causeds

unfairness.

The paper is investigated a scenario that there are n stations .They accidentally sent and receive frames by a access point.

Access point has a buffer that MAC sublayer frames are locate in it and then are transmitted to sender or receiver. The number of station is variable from 5 to 45.

The simulation are run according to DCF,DCF+ and proposed model. The Rd and Ru quantities are measured.

Conclusions

Above simulationed have buun run and the results are shown in mentioned below.It can observable in FIG. 1, the degradation rate of TCP flowsthroughput is less than another method. FIG. 2 show that proposed method base on changed in MAC sub layer have a fair relationship between up and down flow. Actually, when buffer isnot drop download ack packet, downstream flow is not decreased dramatically .

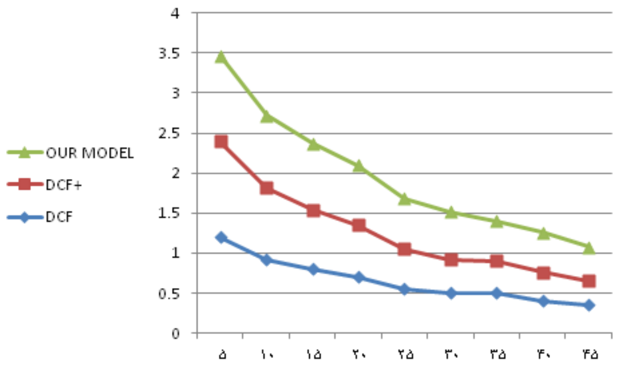

FIG. 1 THROUGHPUT OF TCP FLOWS

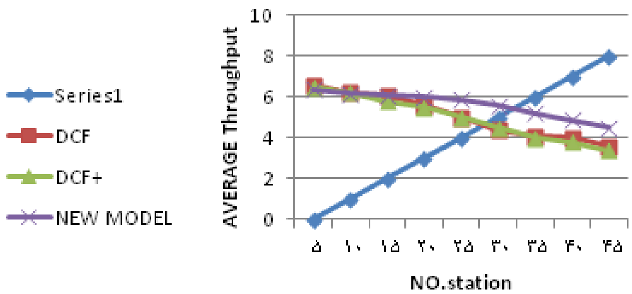

FIG. 2 AVERAGE THROUGHPUT OF TCP FLOWS

As the FIG.1 is shown, all curves (simulated result of each method) have a single bahavior ,all af them have descending shape.

When the number of station is increased, some packets are droped because of the buffer be full. Hence these stations have to resend those frames and the throughput is decreased.

But the main question is, why is the curve of our model decreased less than other methods. Each frame can carry TCP ACK or data packet. The main advantage of this model against DCF and DCF+ is ability to have higher priority to frames which carry TCP ACK packet. Between frames that locate in the buffer of one nodes (firstlevel- priority) : This kind of frame (that carry ACK of TCP) has major priority than frames that ready to send(frames that exist in buffer) in the buffer of one work station.

When the TCP ACK packet correctly receive to station , resending process is not occured and the Rd quantity is not decreased hence average throughput is decreased less that other model.

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